



Attorney's Docket No.: 71300P010

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of: )

Mike G. Roemmler )

Serial No.: 09/802,707 )

Filed: March 8, 2001 )

For: **METHOD OF MAKING EXPANDED  
GRAPHITE WITH HIGH PURITY AND  
RELATED PRODUCTS** )

Patent Office: Lish, Peter J.

Art Unit: 1754

Confirmation No.: 7947

**SUPPLEMENTAL APPEAL BRIEF**

Mail Stop Appeal Brief-Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Appellants submit, in triplicate, the following Supplemental Appeal Brief pursuant to 37 C.F.R. § 1.193(b)(2) and respectfully request reinstatement of an appeal that was the subject of Appellants' Appeal Brief filed on September 22, 2003. This Supplemental Appeal Brief is being filed following the re-opening of prosecution in a non-final Office Action dated December 11, 2003, which the Examiner issued in light of the arguments submitted in Appellants' September 22, 2003 Appeal Brief.

Pursuant to 37 C.F.R. § 1.193(b)(2) and MPEP § 1208.02, Appellants do not submit a fee in connection with this Supplemental Appeal Brief since the fee has been previously paid. Please charge any additional amount due or credit any overpayment to Deposit Account 02-2666.

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## **REAL PARTY IN INTEREST**

Mike G. Roemmler, the party named in the caption, assigned his rights to the invention disclosed in the subject application through an Assignment recorded on March 8, 2001 at reel and frame 011611/0671 to SGL Technic, Inc., 28176 N. Avenue Stanford, Valencia, California 91355. Therefore, SGL Technic, Inc. is the real party in interest.

## **II. RELATED APPEALS AND INTERFERENCES**

There are no other appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in this Appeal.

## **III. STATUS OF CLAIMS**

Claims 1-27 are pending in the application. The Patent Office has rejected Claims 1-27. Appellant appeals the rejection of Claims 1-27.

## **IV. STATUS OF AMENDMENTS**

No amendments to the claims were submitted after the Final Office Action mailed May 27, 2003.

## **V. SUMMARY**

Embodiments describe methods for producing purified expanded graphite in the form of various shapes or powders. Embodiments of articles of manufacture are also described. In one aspect, the claimed methods and articles of manufacture describe higher purity levels of graphite because purification is performed during an expanded state of the graphite. See Application at ¶ 0013.

In one embodiment, the method comprises an acid intercalation, expansion and compacting process of natural graphite with a carbon content of 98 to 99 percent carbon. See Application at ¶ 0011. Representatively, the process of intercalation is accomplished by mixing graphite with an acid, with mixing being performed, for example, by fuming nitric acid at a ratio of 3:1 with the graphite. See Application at ¶ 0019.

In one embodiment, as described in the application, expansion is achieved by exposing the intercalated graphite to a temperature level of 400 to 1200°C. See Application at ¶ 0020. The resulting expansion ratio is, representatively, on the order of 100 to 150 and reflects a bulk density of the graphite of three to five grams per liter (g/l). See Application at ¶ 0011. The expanded graphite may then be compacted to a density of 0.05 to 1.5 g/l to form a “sheet” or “block” material by passing the material through a double belt press. Following compacting, the prepared material may be cut into sheets and purified. See Id.

As further described in the application, in one embodiment, the prepared material is purified by heat treatment in a vacuum furnace. See Application at ¶ 0012. The temperature is raised to a level of 1500 to 3000°C and held at that temperature, depending on the amount of graphite in the furnace, up to about 12 hours. For small amounts or lower density graphite, little (e.g., about 0.5 hours) or no holding time at the high temperature level is necessary. See Id. The vacuum heat treatment then purifies the expanded graphite to impurity levels of about 30 to 500 ppm, typically about 80 to 150 ppm. See Application at ¶ 0012.

From the vacuum furnace, the purified product may be further compressed by a calendaring process or in a hydraulic press or processed into powder. See Application at ¶ 0023. To produce graphite powder, the purified product may be fed into a rotary grinder. See Id. After passing the rotary grinder, the material may optionally be fed to a pin mill. See Id. After passing the rotary grinder or being fed to the pin mill, material may be fed into a fluidized bed air mill. See Id.

## **VI. ISSUES**

The issues involved in this Appeal are as follows:

A. Whether Claims 1-11, 13-21 and 23-27 are unpatentable under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, as obvious over U.S. Patent No. 5,582,811 issued to Greinke, et al. (“Greinke”).

B. Whether Claims 1-11, 13-21 and 23-27 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Greinke in view of U.S. Patent No. 5,505,929 issued to Matsumoto, et al. (“Matsumoto”).

C. Whether Claims 12 and 22 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Greinke in view of Matsumoto, and further in view of U.S. Patent No. 4,533,086 issued to Junttila (“Junttila”).

## **VII. GROUPING OF CLAIMS**

All of the claims do not stand or fall together. Rather, Appellant contends that the claims can be divided into the following groups and each group is separately patentable:

Group I            Claims 1-10, 13-20 and 23- 27

Group II           Claims 11 and 21

Group III          Claims 12 and 22

The basis for the separate patentability of the groups is set forth below.

## **VIII. ARGUMENT**

The Patent Office has rejected Claims 1-11, 13-21 and 23-27 under 35 U.S.C. § 102(b) as being anticipated Greinke.

The Patent Office has rejected Claims 1-11, 13-21 and 23-27 under 35 U.S.C. § 103(a) as being obvious over Greinke in view of Matsumoto.

The Patent Office has rejected Claims 12 and 22 under 35 U.S.C. § 103(a) as being obvious over Greinke in view of Junttila.

### **A. Overview of the Prior Art**

#### **1. Overview of Greinke**

Greinke teaches a stable, blister free flexible graphite foil structure and a method of forming such by performing two chemical reactions including a first step of high temperature heat treatment and a second step of exposing the heat treated graphite to a stabilizing reagent. See Greinke, Abstract. The surface chemistry of the foil is modified to preclude or minimize the amount of water adsorbed into the graphite foil. See Greinke, col. 1, lines 53-56. This is accomplished by converting the graphite foil surface to a stable hydrophobic surface which prevents blistering.

Flexible graphite is made by first treating graphite flakes with agents that intercalate into the crystal structure of the graphite and react to form a compound of graphite and intercalant. See Greinke, col. 3, lines 8-11. Upon heating at a high temperature, the intercalants in the graphite crystal form a gas which causes the layers of the graphite to separate and the graphite flakes to expand or exfoliate in an accordion-like fashion. See Greinke, col. 3, lines 11-14. The exfoliated graphite flakes are then compressed together into sheets. See Greinke, col. 3, lines 16-19.

The natural graphite flakes are intercalated by disbursing the flakes and a solution containing an oxidizing agent, such as a mixture of nitric and sulfuric acid. See Greinke, col. 3, lines 25-28. After washing with water, the intercalated graphite flakes are dried and then exfoliated into flexible graphite by exposing them to a flame for a second or less at temperatures greater than 700°C, or typically 1000°C. See Greinke, col. 3, lines 36-40. The exfoliated graphite flakes are then compressed and rolled into a densely compressed graphite foil sheet of a desired density and thickness. See Greinke, col. 3, lines 40-42.

A stable blister-free flexible graphite foil is prepared by subjecting the graphite particles to two chemical reactions. See Greinke, col. 4, lines 25-27. The two chemical reactions can occur separately or simultaneously and can be integrated into the foil fabricating procedure or applied subsequent to the manufacture of the foil. See Greinke, col. 4, lines 32-35. The first chemical reaction is a high temperature heat treatment of either the standard graphite flake, the low-density mat, or the standard density foil for a controlled time period based upon the heat treatment temperature. See Greinke, col. 4, lines 35-39. When the heat treatment temperature is above 900°C, heat treatment should be from 20 seconds to not less than 5 seconds at the highest temperature, whereas when the heat treatment is at 600°C, a minimum time period of one to thirty minutes is necessary. See Greinke, col. 4, lines 40-44. When the heat treatment is between 600°C to 900°C, the heat treatment time is between 30 minutes and 20 seconds, respectively. See Greinke, col. 4, lines 44-46.

Upon cooling, oxygen and water in air react at the unsaturated sites forming functional hydrophilic groups. See Greinke, col. 4, lines 59-61. The heat-treated flexible graphite is exposed

to stabilizing reagents such as hydrogen, hydrogen chloride, chlorine, bromine, chloride, nitric acid, and phosphoric acid. See Greinke, col. 4, lines 61-65. This second reaction prevents blistering by stabilizing the active sites in the graphite surface to minimize the reaction with water, oxygen and air. See Greinke, col. 4, lines 65-67.

Two circumstances require a second heat treatment in order to produce a stable blister-free flexible graphite:

- (a) when the first heat treatment and stabilization reaction occurs with the starting graphite flake; or
- (b) when the first heat treatment occurs after exfoliation and the subsequent stabilization reaction involves using an acidic reagent, such as hydrochloric acid-nitric acid. See Greinke, col. 5, lines 30-37.

The second treatment has a temperature limitation which is below the fracturing temperature of the stabilizing functional group, 1000°C, but above the temperature required to remove the acid functional groups, 600°C. See Greinke, Col. 5, lines 38-54.

In one example, Greinke teaches that a flake was intercalated using an excess of intercalating solution consisting of 92% sulfuric acid and 8% nitric acid. See Greinke, col. 8, lines 20-22. The intercalated product was washed, dried, exfoliated, and then rolled into foil of standard dimension. See Greinke, col. 8, lines 22-24. The foil was slowly heated to 1700°C and then subjected to chlorine gas. See Greinke, col. 8, lines 22-24.

## **2. Overview of Matsumoto**

Matsumoto teaches a method for manufacturing graphite material. See Matsumoto, col. 3, lines 4-11. The method includes a baking process of a carbon material, a graphitizing process of the material and a highly purifying process of the material in sequential order, the highly purifying process of the material being carried out by high frequency heating means under vacuum or reduced pressure. See Matsumoto, Abstract. An object of Matsumoto is to provide a high purification process and an apparatus thereof in which graphitization and high purification are carried out in one furnace to reduce the cost in conveying carbon material, to prevent energy loss

due to the breakdown of carbon material during a cooling and heating cycle, to improve the rate of operation and to reduce the consumption of halogen. See Matsumoto, col. 2, lines 57-65.

Matsumoto teaches a method carried out by an apparatus which includes a container capable of being made vacuous or depressurized in which an induction heating high-frequency coil and a graphite heater are incorporated. See Matsumoto, col. 3, lines 11-16. Carbon material is gradually heated to 800°C-1000°C for one to ten hours with a pressure of one to 100 Torr. See Matsumoto, col. 4, lines 53-58 and lines 62-65. The temperature is then raised to 2,450°C to 2,500°C by gradual heating so that the material is graphitized after being kept within such temperature range for 5-24 hours. See Matsumoto, col. 4, lines 57-61.

After graphitization has proceeded “to a certain extent,” a halogen gas is fed from a gas supply pipe while keeping a reduced pressure state to purify the material. See Matsumoto, col. 4, lines 66 to col. 5, lines 2 (emphasis added to quoted phrase). After purification, the temperature in the furnace is further raised and kept at 3,000°C for ten to thirty hours and the process is completed. See Matsumoto, col. 5, lines 24-27.

Matsumoto claims that purification can be further improved by largely reducing the container pressure to  $10^{-2}$  to  $10^{-4}$  Torr at a temperature of 1800°C to 2200°C during the cooling stage of the furnace. See Matsumoto, col. 5, lines 28-31. Moreover, Matsumoto claims that an advantage to the sequential order is that the process can be carried out in one furnace which improves thermal efficiency and the rate of operation of the apparatus. See Matsumoto, col. 6, line 64 to col. 7, line 6.

### **3. Overview of Junttila**

Junttila teaches a process for grinding graphite to provide graphite particles reduced in size. The process Junttila teaches includes: “(1) forming a mixture of graphite and a graphite grinding aid; (2) grinding the mixture of graphite and graphite grinding aid to provide graphite particles reduced in size; (3) forming an aqueous slurry of the graphite particles, graphite grinding aid and water; (4) adding an amount of hydrocarbon oil to the aqueous slurry with agitation to form graphite-oil agglomerates; (5) separating the graphite-oil agglomerates from the grinding aid and water; and (6) removing hydrocarbon oil from the graphite-oil agglomerates to provide graphite



particles reduced in size.” Junttilla, Abstract. In describing the method, Junttilla states, “While a variety of mechanical methods have been employed heretofore for grinding graphite, there is a clear need for a more effective and efficient process for grinding graphite.” Junttilla, col. 2, lines 3-6.

**B. Rejection of Group I Under 35 U.S.C. § 102(b) as Being Anticipated by Greinke**

To anticipate a claim, the relied upon reference must disclose every limitation of the claim. The claims in Group I, among other elements, include purifying a graphite material at a temperature of at least 1750°C.

In making the rejection, the Patent Office cites Greinke as teaching each of the elements of the Group I claims. However, the Patent Office notes that Greinke “does not explicitly teach the use of a temperature of at least 1750°C for the heat treatment.” Paper No. 13, page 3. The Patent Office asserts that Greinke teaches a heat treatment at a temperature of at least 600°C and since there is no upper limit to this teaching and in two examples Greinke shows temperatures of 1700°C, it would have been obvious to one of ordinary skill in the art at the time of invention to use a temperature of at least 1750°C for the heat treatment of Greinke since “any temperature above 600°C is expected to perform the required treatment.” Appellant disagrees.

The Patent Office’s assertion that any temperature above 600°C is expected to perform the required treatment is simply not supported by the teachings in Greinke. Greinke teaches that:

The purpose of the second heat treatment is to remove from the graphite surface, hydrophilic acid groups introduced either by the intercalant or by the acidic stabilization reagent, without removal of the desired hydrophobic stabilization functional groups, such as those which contain phosphorous or chlorine. Therefore, the second heat treatment should have a temperature limitation which is below the fracturing temperature of the stabilizing functional group but above the temperature required to remove the acid functional groups of above about 600°C. Greinke Col. 5, lines 38-47 (emphasis added).

This passage suggests that there is an upper limit to the heat treatment of Greinke since there is an undesirable fracturing temperature. This upper limit must be about 1000°C since Greinke states, “the second heat treatment should go between 600° and about 1000°C for a controlled time period with a longer hold time required for the 600°C. temperature and a shorter hold time required for the

higher 1000°C. temperature.” Greinke, Col. 5, lines 50-54. This suggests there is an upper limit and that upper limit is 1000°C since Greinke refers to “the higher 1000°C temperature,” the highest temperature in the range, in the singular. This also suggests that the fracturing temperature is 1000°C and any temperature above 1000°C would be unacceptable since it will cause the stabilizing functional group to fracture. Thus, one skilled in the art reading Greinke would not have had the proper motivation to use temperatures of at least 1750°C for fear of causing the stabilizing functional group to fracture.

Greinke shows examples that have a maximum temperature of 1700°C but does not suggest these examples are useful especially in light of the above argument that 1000°C is the highest allowable temperature, the fracture temperature, taught by Greinke. In addition, Example 10 of Greinke, which uses 1200°C, is equally non-suggestive since Greinke teaches that the product, which was supposed to be blister-free, blistered after only 90 days. See Greinke, Col. 7, lines 33-36. Therefore, there would be no motivation for one skilled in the art to look at temperatures above 1000°C when reading Greinke since each example resulted in an unacceptable product. Therefore, there is no teaching or suggestion in Greinke of a temperature of at 1750°C as recited in the claims of Group I.

Additionally, to raise the temperature from the 600°C to 1000°C range to at least 1750°C requires greater power and thus, is more expensive to attain. Therefore, one skilled in the art would not be inclined to use a more costly, more difficult approach to accomplish the same task, especially in light of the fact that each of the examples gave unacceptable results. Again, there is no suggestion or motivation in Greinke to use temperatures of at least 1750°C. Accordingly, it is requested that the anticipation/obviousness rejection of the independent claims of Group I be overturned.

The remaining claims in Group I each depend from an independent claim included in Group I and contain all of the limitations thereof. Therefore, for the reasons discussed above with regard to the independent claims, Claims 2-10, 14-20, 23 and 25-27 are not anticipated/obvious over

Greinke. Accordingly, it is requested that the anticipation/obviousness rejection of the Group I claims be overturned.

**C. Rejection of Group II Under 35 U.S.C. § 102(b) as Being Anticipated by Greinke**

Regarding Claims 11 and 21, these claims include all of the elements of independent Claims 1 and 13, respectively. Therefore, the discussion above regarding Greinke failing to teach or suggest each of the elements of Group I is equally applicable to Group II.

In addition, Claims 11 and 21 include, among other elements, following purifying, one of grinding and compacting graphite material. In making the rejection, the Patent Office states Greinke “teaches that the final heat treatment and stabilizing steps may be performed (in the manner as above) on the exfoliated worms, before compression, or compacting, to sheets or foils.” Appellant disagrees.

The Patent Office fails to cite any sections of Greinke for teaching or suggesting the elements of Group II. In reviewing Greinke, Appellant cannot find any section that teaches or suggests following purifying, one of grinding and compacting graphite material. In fact, Greinke does not teach or suggest any step occurring after a second heat treatment, if the second heat treatment is even necessary. See Greinke, Col. 5, lines 31-54. Therefore, Greinke fails to teach or suggest each of the elements of the Group II claims since Greinke does not teach or suggest anything occurring following purifying. Thus, Greinke cannot teach or suggest following purifying one of grinding and compacting graphite material. Accordingly, it is requested that the anticipation/obviousness rejection of the Group II claims be overturned.

**D. Rejection of Group III Under 35 U.S.C. § 103(a) as Being Obvious over Greinke in View of Junttila.**

In regard to Claims 12 and 22, these claims include all of the limitations of Claims 1 and 13, respectively. Therefore, the discussion above regarding Greinke failing to teach or suggest each of the elements of Group I is equally applicable to Group III.

Appellant notes Junttila is not cited for teaching or suggesting following purifying, one of grinding and compacting graphite material. Moreover, Appellant has reviewed Junttila and submits

that combining Junttila with Greinke does not cure the defects of Greinke discussed with regard to Group I since Appellant cannot discern any section of Junttila that teaches or suggests following purifying compacting the graphite materials. Therefore, Junttila fails to cure the defects of Greinke.

In addition, Claims 12 and 22, among other elements, include following purifying, compacting graphite material and following compacting, grinding graphite material. Appellant has reviewed Greinke and Junttila and cannot discern any sections of these references that teach or suggest following purifying, compacting graphite material and following compacting, grinding graphite material. Greinke teaches compressing exfoliated graphite particles, however, compression occurs before any heat treatment, not after purifying as recited in Claims 12 and 22. Moreover, the Patent Office admits Greinke does not teach any grinding (See Paper No. 13, page 4) so this necessarily means that Greinke does not teach or suggest after compacting, grinding graphite material. Therefore, Greinke fails to teach or suggest following purifying, compacting graphite material and following compacting, grinding graphite material.

The Patent Office does not cite Junttila for teaching or suggesting following purifying, compacting graphite material, nor does the Patent Office cite Junttila for teaching or suggesting following compacting, grinding graphite material. The Patent Office cites Junttila for teaching a method of grinding the graphite materials of Greinke in order to produce ground graphite. See Paper No. 13, page 4. However, as Appellant discussed above, Greinke does not teach or suggest anything occurring after the second heat treatment, let alone compacting graphite material and then grinding graphite material.

In addition, in reviewing Junttila, Appellant cannot find any sections that teach or suggest following purifying, compacting graphite material and following compacting, grinding graphite material. In fact, Junttila does not teach or suggest any steps occurring prior to grinding graphite material. Junttila simply takes graphite from an undisclosed source and applies Junttila's method to the graphite. Therefore, since Junttila does not teach or suggest any steps occurring before grinding, and Greinke does not teach any steps occurring after the second heat treatment, the

combination of Greinke and Junttila fails to teach or suggest following purifying, compacting graphite material and fails to teach or suggest compacting and grinding graphite material.

Thus, the combination of Greinke and Junttila does not teach or suggest each of the elements of the claims in Group III. Therefore, Group III is separately patentable because it includes these elements that are not taught or suggested by the cited references. Accordingly, it is requested that the obviousness rejection of Group III be overturned.

**E. Rejection of Group I Under 35 U.S.C. § 103(a) as Being Obvious Over Greinke in View of Matsumoto**

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. See MPEP § 2143; See also In re Ray Baeck, 947 F.2d 488 20 U.S.P.Q. 2d 1438 (Fed.Cir. 1991).

Claims 1, 13 and 24, among other elements, include purifying a graphite material at a temperature of at least 1750°C. The Patent Office cites Greinke for teaching the elements of the claims of Group I. However, the Patent Office notes Greinke does not teach a temperature above 1700°C for a heat treatment step. The Patent Office cites Matsumoto as teaching higher temperatures of purification to remedy the defects of Greinke. Appellant submits there is no motivation or suggestion to combine the process of forming blister-free flexible graphite taught in Greinke with the higher temperatures of the unrelated, unique Matsumoto process of baking, graphitizing and purifying graphite material in sequential order.

As a preliminary matter, Matsumoto's method involving the cited heat treatment relates to a sequential process of (1) graphitizing carbon material and (2) purifying the graphitized material. Matsumoto does not describe a purifying of expanded graphite material at a temperature above 1750°C. Further, Matsumoto teaches that carbon material is gradually heated to and kept at 800-1000°C for one to ten hours and preferably three to five hours. See Matsumoto, col. 4, lines 54-58.

Thereafter, the temperature is gradually raised to 2450-2500°C for 5-24 hours and then raised to 3000°C for ten to thirty hours. See Matsumoto, col. 4, lines 58-61. After this, the temperature is reduced to the 1800-2200°C range cited by the Patent Office. See Matsumoto, col. 5, lines 25-27. Therefore, Matsumoto's strict sequential method teaches that carbon material must be exposed to a temperature of 800-1000°C for at least an hour before reaching 1750°C.

The Federal Circuit Court of Appeals states that the "teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." MPEP § 2142 (citing In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)). To combine the temperature taught in Matsumoto with the method taught in Greinke requires, first of all, a recognition that graphitization and purification of graphite thus formed processes have some relation to expanded graphite purification. The combination of the temperature taught in Matsumoto with Greinke also requires that the graphite material in Greinke be exposed to 800-1000°C heat for at least an hour, then exposure to temperatures greater than 1000°C for some amount of time before reaching 1750°C. With regard to the heating exposure, the Patent Office is taking a step that occurs at least in the middle of a sequential, multiple-step heating and cooling process described in Matsumoto and claims that an entire heat treatment can be substituted by that single step. There is no motivation or suggestion in the references for this substitution.

Greinke teaches when the temperature is above 900°C, a first heat treatment should be from twenty seconds to not less than five seconds. See Greinke, col. 4, lines 40-44. If a temperature of 600°C is used, a minimum time period of one to thirty minutes is necessary. See Id. If a temperature of between 600°C-900°C is used, the heat treatment time is between thirty minutes and twenty seconds, respectively. See Greinke, col. 4, lines 44-46.

This teaching excludes the possibility of being combined with Matsumoto since the heating method of Matsumoto (one to ten hours at 800°C-1000°C) would require that the material go through Greinke's heat treatment at least twice (two times thirty minutes at 600°C-900°C) before being subjected to the claimed purifying temperature of at least 1750°C. This is simply not

contemplated by the references since this is clearly two heat treatments (two treatments for 30 minutes at 600°C-900°C plus one treatment at a minimum of 1750°C) beyond the teachings of Greinke. Moreover, Matsumoto teaches a process of forming graphite from carbon material and purifying in a single furnace without removal of the material. Matsumoto does not teach or suggest that the process can be performed on exfoliated graphite material which is compressed prior to heat exposure. Therefore, there is no suggestion or motivation to combine the method of Greinke with the unrelated method of Matsumoto.

In addition, MPEP § 2143.01 states, “If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.” MPEP § 2143.01 (citing In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)). The Patent Office cites examples in Greinke for teaching a heat treatment up to 1700°C. See Paper No. 4, page 3. Regarding a first heat treatment, Greinke states, “[w]hen the heat treatment is above 900°C. heat treatment should be from 20 seconds to not less than 5 seconds at the highest temperature...” and “[w]hen the heat treatment is between 600°C and 900°C the heat treatment time is between 30 minutes and 20 seconds respectively.” Greinke, col. 4, lines 40-46. The examples cited by the Patent Office do not disclose how long the materials were exposed to the 1700°C heat, but from the Application, the exposure time to 1700°C heat was not more than 20 seconds.

Temperature teachings of Matsumoto cannot be combined with the heat treatments taught in Greinke because using the teachings of Matsumoto in combination with Greinke would destroy the intended purpose of Greinke’s method. Matsumoto’s time for heat exposure is at least twice as long as Greinke since Greinke teaches graphite material should be exposed to 600-900°C heat for a maximum of 30 minutes during the first heat treatment. In addition, the combination of Greinke and Matsumoto would require additional exposure to temperatures of 800-1000°C before reaching the recited at least 1750°C limitation in the Group I claims.

In addition, reaching 1750°C after being heat-treated for at least one hour at a temperature of 800-1000°C constitutes, by definition, a second heat treatment under Greinke since Greinke teaches

that a first heat treatment is 30 minutes of exposure to 600-900°C heat. See Greinke, col. 4, lines 35-46. Therefore, any additional exposure to heat beyond the first heat treatment, in this case raising the temperature to at least 1750°C, is, by definition, a second heat treatment.

Greinke teaches a second heat treatment, but there are only two circumstances requiring a second heat treatment in order to produce a stable blister-free flexible graphite. See Greinke, col. 5, lines 30-37. Greinke teaches that the second heat treatment must have a temperature limitation which is below the fracturing temperature of the stabilizing functional group, but above the temperature required to remove the acid functional groups, in the range of about 600°C to about 1000°C. See Greinke, Col. 5, lines 43-54. Therefore, Greinke teaches that any exposure to heat above 1000°C in the second heat treatment fractures the stabilizing functional group.

Stabilized functional groups prevent blistering because they minimize the reaction of the active sites with water and oxygen in air. See Greinke, col. 4, lines 59-67. However, if these groups are fractured, their ability to minimize the reaction of the active sites with water and oxygen in air, and thus prevent blistering, is diminished. Therefore, Greinke and Matsumoto cannot be combined because when the temperature is gradually increased above 1000°C to reach at least 1750°C the graphite in Greinke would eventually fracture allowing, according to Greinke, the active sites to react with water and oxygen to create blistering.

Since a purpose of Greinke is to prevent blistering, there is no suggestion or motivation to combine Greinke and Matsumoto because the combination will cause the graphite to blister, which renders an intended purpose of Greinke unsatisfactory. Therefore, the combination of Greinke and Matsumoto does not teach or suggest each of the elements of independent Claims 1, 13 and 24 because the combination of Greinke and Matsumoto's invention unsatisfactorily for its intended purpose. Accordingly, it is requested that the obviousness rejection of Claims 1, 13 and 24 be overturned.

The remaining claims in Group I each depend from an independent claim included in Group I and contain all of the limitations thereof. Therefore, for the reasons discussed above with regard to the independent claims, Claims 2-10, 14-20, 23 and 25-27 are not obvious over Greinke in view



of Matsumoto. Accordingly, it is requested that the obviousness rejection of the Group I claims be overturned.

**F. Rejection of Group II Under 35 U.S.C. § 103(a) as Being Obvious over Greinke in View of Matsumoto**

Regarding Claims 11 and 21, these claims include all of the limitations of independent Claims 1 and 13, respectively. Therefore, the discussion above regarding Greinke and Matsumoto failing to teach or suggest each of the elements of Group I is equally applicable to Group II.

In addition, Claims 11 and 21 include, among other elements, following purifying, one of grinding and compacting graphite material. In making the rejection, the Patent Office states Greinke “teaches that the final heat treatment and stabilizing steps may be performed (in the manner as above) on the exfoliated worms, before compression, or compacting, to sheets or foils.” Appellant disagrees and notes Matsumoto is not cited for teaching or suggesting following purifying, one of grinding and compacting graphite material.

The Patent Office fails to cite any sections of Greinke for teaching or suggesting the elements of Group II. In reviewing Greinke, Appellant cannot find any section that teaches or suggests following purifying, one of grinding and compacting graphite material. In fact, Greinke does not teach or suggest any step occurring after a second heat treatment, if the second heat treatment is necessary. See Greinke, Col. 5, lines 31-54. Therefore, Greinke fails to teach or suggest each of the elements of the Group II claims since Greinke does not teach or suggest anything occurring following purifying. The Patent Office relies on Matsumoto to cure the defects of Greinke.

Matsumoto teaches a sequential process where carbon material is placed in a furnace and heated to several temperature levels to purify the carbon material. The Patent Office does not cite Matsumoto for teaching or suggesting following purifying, one of grinding and compacting graphite material. The Patent Office cites Matsumoto for teaching purification can be improved by reducing the container pressure at the temperature of 1800-2200°C. See Paper No. 13, page 5.

In addition, Appellant has reviewed Matsumoto and cannot discern any section of Matsumoto that teaches or suggests grinding or compacting after purifying. In fact, Appellant cannot find any step being taught in Matsumoto after the heating process. Therefore, Matsumoto fails to cure the defects of Greinke.

Thus, the combination of Greinke and Matsumoto does not teach or suggest each of the elements of the claims in Group II. Therefore, Group II is separately patentable because it includes these elements that are not taught or suggested by the cited references. Accordingly, it is requested that the obviousness rejection of the Group II claims be overturned.

**G. Rejection of Group III Under 35 U.S.C. § 103(a) as Being Obvious over Greinke in View of Matsumoto, and in Further View of Junttila.**

In regard to Claims 12 and 22, these claims include all of the limitations of Claims 1 and 13, respectively. Therefore, the discussion above regarding there being no motivation or suggestion to combine Greinke and Matsumoto (Group I) is equally applicable to Group III.

In addition, the Patent Office does not combine Junttila with Greinke and Matsumoto to cure the defects of Greinke and Matsumoto in Claims 1 and 13. Moreover, Applicants have reviewed Junttila and submit that combining Junttila with Greinke and Matsumoto does not cure the defects of Greinke and Matsumoto discussed with regard to Group I.

In addition, Claims 12 and 22, among other elements, include following purifying, compacting graphite material and following compacting, grinding graphite material. Appellant has reviewed Greinke, Matsumoto and Junttila and cannot discern any sections of these references that teach or suggest following purifying, compacting graphite material and following compacting, grinding graphite material.

Greinke teaches compressing exfoliated graphite particles, however, compression occurs before any heat treatment, not after purifying as recited in Claims 12 and 22. Moreover, the Patent Office admits Greinke does not teach any grinding (See Paper No. 13, page 5) so this necessarily means that Greinke does not teach or suggest after compacting, grinding graphite material.

Therefore, Greinke fails to teach or suggest following purifying, compacting graphite material and following compacting, grinding graphite material.

Matsumoto teaches a sequential process where carbon material is placed in a furnace and heated to several temperature levels to purify the carbon material. The Patent Office does not cite Matsumoto for teaching or suggesting following purifying, compacting graphite material, nor does the Patent Office cite Matsumoto for teaching or suggesting following compacting, grinding graphite material. The Patent Office cites Matsumoto for teaching purification can be improved by reducing the container pressure at the temperature of 1800-2200°C. See Paper No. 6, page 2.

In reviewing Matsumoto, Appellant cannot find any sections that teach or suggest following purifying, compacting graphite material and following compacting, grinding graphite material. In fact, Appellant cannot find any step being taught in Matsumoto after the heating process. Therefore, Matsumoto fails to teach or suggest these elements.

The Patent Office does not cite Junttila for teaching or suggesting following purifying, compacting graphite material, nor does the Patent Office cite Junttila for teaching or suggesting following compacting, grinding graphite material. The Patent Office cites Junttila for teaching a method of grinding graphite materials in order to produce ground graphite. See Paper No. 13, pages 5-6.

In reviewing Junttila, Appellant cannot find any sections that teach or suggest following purifying, compacting graphite material and following compacting, grinding graphite material. In fact, Junttila does not teach or suggest any steps occurring prior to grinding graphite material. Junttila simply takes graphite from an undisclosed source and applies Junttila's method to the graphite. Therefore, since Junttila does not teach or suggest any steps occurring before grinding, Junttila fails to teach or suggest following purifying, compacting graphite material and fails to teach or suggest compacting and grinding graphite material.

Thus, the combination of Greinke, Matsumoto and Junttila does not teach or suggest each of the elements of the claims in Group III. Therefore, Group III is separately patentable because it

includes these elements that are not taught or suggested by the cited references. Accordingly, it is requested that the obviousness rejection of Group III be overturned.

#### IX. CONCLUSION AND RELIEF

Accordingly, it is submitted that the rejections of Groups I-III based on 35 U.S.C. § 103(a) be overturned.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: \_\_\_\_\_

5/11/04

William T. Babbitt  
William T. Babbitt, Reg. No. 39,591

12400 Wilshire Blvd.  
Seventh Floor  
Los Angeles, California 90025  
(310) 207-3800

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Nadya Gordon  
Nadya Gordon

5/11/04  
Date

**X. APPENDIX**

The claims involved in this Appeal are as follows:

1. A method comprising:  
expanding a graphite material from a first density to a smaller second density; and  
following expansion, purifying the graphite material at a temperature of at least 1750°C.
2. The method of claim 1, wherein the graphite material comprises a natural graphite flake.
3. The method of claim 1, wherein expanding a graphite material comprises:  
combining the graphite material with an intercalating agent.
4. The method of claim 3, wherein the intercalating agent is nitric acid.
5. The method of claim 4, wherein expanding the graphite material comprises:  
combining the graphite material and the intercalating agent at a graphite material to  
intercalating agent at a ratio of about three to one.
6. The method of claim 3, wherein expanding the graphite material comprises, after combining  
the graphite material with the intercalating agent, subjecting the graphite material to a thermal  
treatment.
7. The method of claim 6, further comprising:  
prior to purifying, compacting the graphite material.
8. The method of claim 6, wherein the thermal treatment comprises a first thermal treatment  
and purifying the graphite comprises subjecting the graphite material to a second thermal treatment  
under vacuum at a temperature in the range of 1750 to 3000°C.
9. The method of claim 8, wherein subjecting the graphic material to a second thermal  
treatment further comprises introducing an auxiliary gas into the vacuum environment.
10. The method of claim 9, wherein the auxiliary gas comprises chlorine.

11. The method of claim 1, further comprising:  
following purifying, one of grinding and compacting the graphite material.
12. The method of claim 1, further comprising:  
following purifying, compacting the graphite material; and  
following compacting, grinding the graphite material.
13. A method comprising:  
expanding a graphite material;  
following expansion, compacting the graphite material; and  
following compaction, purifying the graphite material at a temperature of at least 1750°C.
14. The method of claim 13, wherein expanding a graphite material comprises:  
combining the graphite material with an intercalating agent.
15. The method of claim 14, wherein the intercalating agent is nitric acid.
16. The method of claim 15, wherein expanding the graphite material comprises:  
combining the graphite material and the intercalating agent at a graphite material to  
intercalating ratio of about three to one.
17. The method of claim 13, wherein expanding the graphite material comprises, after  
combining the graphite material with the intercalating agent, subjecting the graphite material to a  
first thermal treatment.
18. The method of claim 17, wherein purifying the graphite material comprises a second thermal  
treatment and the second thermal treatment comprises purifying under vacuum at a temperature in  
the range of 1750 to 3000°C.
19. The method of claim 17, wherein subjecting the graphic material to a second thermal  
treatment further comprises introducing an auxiliary gas into the vacuum environment.
20. The method of claim 19, wherein the auxiliary gas comprises chlorine.

21. The method of claim 13, further comprising:  
following purifying, one of grinding and compacting the graphite material.
22. The method of claim 13, further comprising:  
following purifying, compacting the graphite material; and  
following compacting, grinding the graphite material.
23. The method of claim 13, wherein the graphite material comprises a natural graphite flake.
24. An article of manufacture comprising graphite formed according to a method comprising:  
expanding a graphite material from a first density to a smaller second density; and  
following expansion, purifying the graphite material at a temperature of at least 1750°C.
25. The article of manufacture of claim 24, wherein expanding a graphite material comprises:  
combining the graphite material with an intercalating agent.
26. The article of manufacture of claim 25, wherein the intercalating agent is nitric acid.
27. The article of manufacture of claim 24, wherein the graphite material comprises a natural graphite flake.